THE AUDIOMETER & TEST ENVIRONMENT

Audiometer & Test Environment

- The audiometer and test environment are critical to the validity and accuracy of audiometric testing results.

Equipment Used for Testing

- Sound-treated test booth
- Audiometer
- Headphones/earphones
- Electroacoustic ear or human listener
- Handswitch/response switch

Test Environment

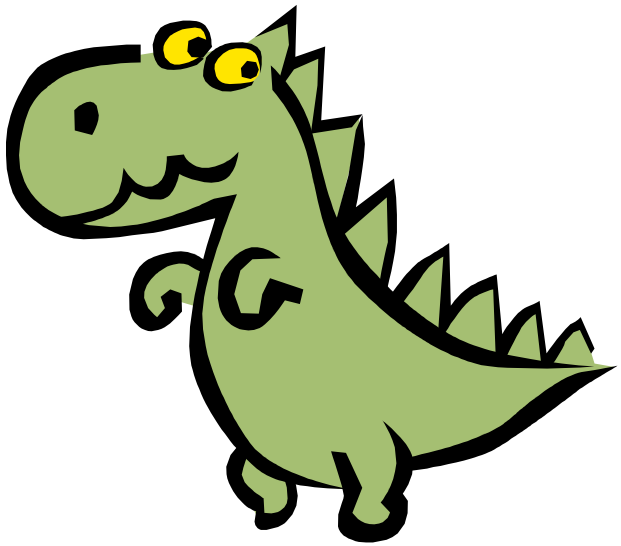
- Audiometric Booth Certification
  - Booths are not sound-proof, they are **sound-treated**. Noise levels inside the booth must meet ambient noise level criteria
  - Excessive background noise during patient testing may interfere with test results and elevate patient thresholds in the 250-500 Hz range

Test Environment

- Booth certification is required annually in accordance with ANSI S3.1. Noise levels inside the booth must be below established maximum levels
- Certification is typically performed by an Industrial Hygienist, Audiologist or trained technician
- Certification documentation must be placed in plain view of patients, typically on the outside of the booth door or wall

Potential Causes of Excessive Noise in the Booth

- Deterioration of door seals
- Leaks around jack panels
- Ventilation noise
- Excess internal noise



Solutions for Excessive Noise in the Booth

- Replace door seals
- Repair/replace jack panel
- Repair/replace ventilation fan
- Control exterior noise or change test schedule
- Relocate booth

What is an “Audiometer”?

- **An audiometer is an electronic instrument which measures hearing sensitivity through the use of calibrated pure-tone signals of known frequency and intensity.**
- **Most reference and monitoring audiograms are performed on microprocessor audiometers.**

Manual Audiometers

- **Test one person at a time**
- **Examiner controls the stimulus**
- **Tone presentation length and “silent” interval may vary from examiner to examiner**
- **No computerized printout (unless linked to computer)**

Manual Audiometers

- Requires manual STS calculations
- Results are manually recorded (by hand)
- Test results must be entered into the microprocessor database as soon as possible
- Audiologists use manual audiometers for diagnostic testing and document hearing status on a graph using X=left ear and O=right ear
- Technicians may be required to transcribe Audiologists test results into the microprocessor database for future reference

Microprocessor Audiometers

- **Audiometer is connected to a computer and testing is managed by the software**
- **Test individuals or groups (dependent on booth configuration)**
- **Patient response controls the stimulus**
- **Test is the same regardless of examiner**
- **Automatic Audiogram review, STS calculations & documentation of OSHA recordable hearing losses**

Microprocessor Audiometers, con't.

- **Generates computerized printout of DD 2215/2216 forms**
- **Also capable of testing in a manual mode**
- **Capability of uploading to central repository over internet**
- **Microprocessor audiometers are used exclusively in all DoD HCP's**
- **Require proper maintenance: software upgrades, look-up table updates, data back-ups**

DoD Microprocessor Audiometers

- DoD uses the Defense Occupational & Environmental Health Readiness System – Hearing Conservation (DOEHRS-HC) software for all HC testing
- The DOEHRS Data Repository (DR) is the central database where all tests are exported at least weekly

Other System Components

- Electroacoustic calibrator/Artificial Ear
  - Used to verify calibration status of the audiometer
  - Artificial ear is plugged into the handswitch jack for the Biological Calibration Check
  - Human listener is an alternative to using an artificial ear (if one is not available)
- Headphones/Earphones
  - A delicate part of the system, utilized by multiple patients per day

Audiometer Electroacoustic Calibration

Don’t confuse this with the daily biologic calibration

- Audiometric test equipment must be electroacoustically calibrated annually
- Meet the specific requirements stated in current version ANSI S3.6
- The audiometer will be tagged with a calibration Sticker which will state the date of next calibration
- Audiometers and headphones are calibrated together as a unit. Swapping headphones changes calibration! Always send headphones with units being repaired.
- Immediately following the annual calibration, establish a new DD2217 (biologic calibration) for each listener

Functional Listening Check

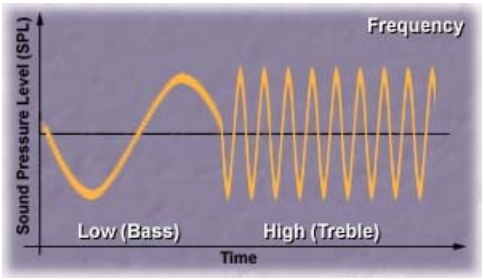
- A hands-on thorough equipment check
- Performed daily by the Hearing Conservation Technician
- Purpose is to detect any hardware problems and ensure equipment is working properly before seeing the first patient of the day

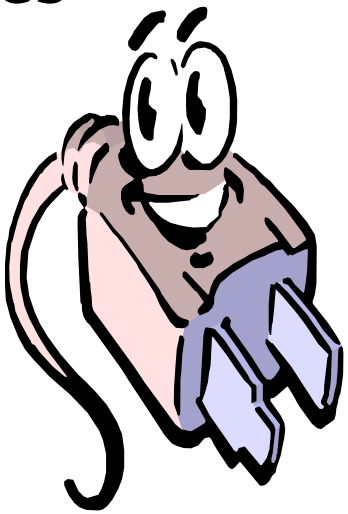
Visual Check of Equipment

- Earphone headband tension
- Earphone cushions
- Diaphragms
- Cords and connections

Listening Check

- Listen through headphones for
  - Frequency changes
  - Intensity changes
  - Tone quality
  - Crosstalk
  - Static





Biological Calibration Check

- Verifies that calibration is current by comparing hearing of a subject with baseline test of known hearing levels.
- Ensures the audiometer doesn’t develop a problem between annual electroacoustic calibrations.
- Performed immediately after annual calibration and daily on every audiometer prior to use.
- Electro-acoustic ear preferred for stability, however may use a normal hearing human listener
- The DD 2217 Form establishes a legal record verifying the audiometer’s function, and must be maintained for 5 years

Daily Biological Calibrations (cont.)

- Human Listeners must have normal hearing (all thresholds less than 25 dB)
- Artificial ears can be used for this daily calibration, however, a secondary listener (or back-up artificial ear) is still necessary.
- Artificial ear thresholds range between 60 and 80 dB

Daily Biological Calibration Check, con't

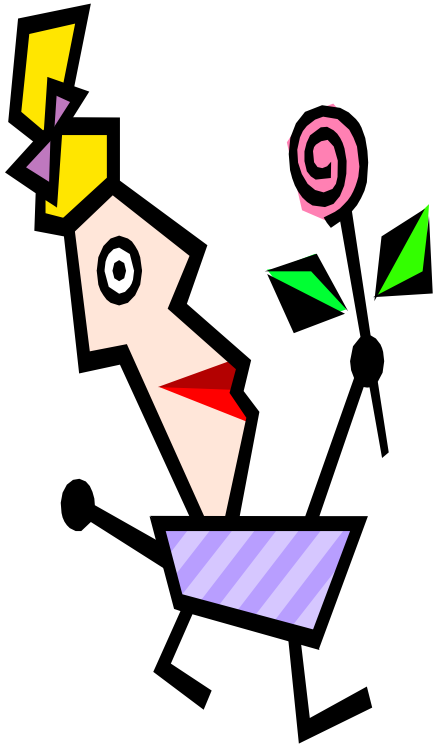
- Immediately following annual calibration, record the baseline thresholds for a primary and alternate listener for each audiometer. If only human listeners used, need at least 2 alternates.
- Daily calibration check must not differ from baseline calibration check by more than +/- 5 dB at 500-4000 Hz & +/- 10 dB at 6000 Hz.
- If audiometer fails daily calibration, check all connections and condition of earphones, repeat bio-cal.
- Use second listener if problem persists.
- If audiometer fails calibration with 2nd listener, send out for repair and use backup audiometer (if available).

Causes for Failed Daily Calibration Check

In order of likelihood of occurrence…

- Improper earphone placement
- Poor connections at jack panel or to audiometer
- Worn out/flattened earphones
- Weak or dead batteries (older model Oscars only)
- Audiometer electroacoustic calibration has expired
- Malfunctioning artificial ear
- Malfunctioning audiometer

Audiometer Care & End of Day Procedures



- Clean Earphone cushions daily with disinfectant (non-alcohol) wipes. Keep moisture away from diaphragms.
- Hang earphones on hook to maintain proper headband tension.
- Replace earphone cushions, cords and hand switches as needed.

  * **These components do not affect the audiometer calibration**
- Back up audiometric data on an external drive.
- Properly shut down the system, so as not to cause data corruption.

Infection Control
Critical Audiometric Equipment

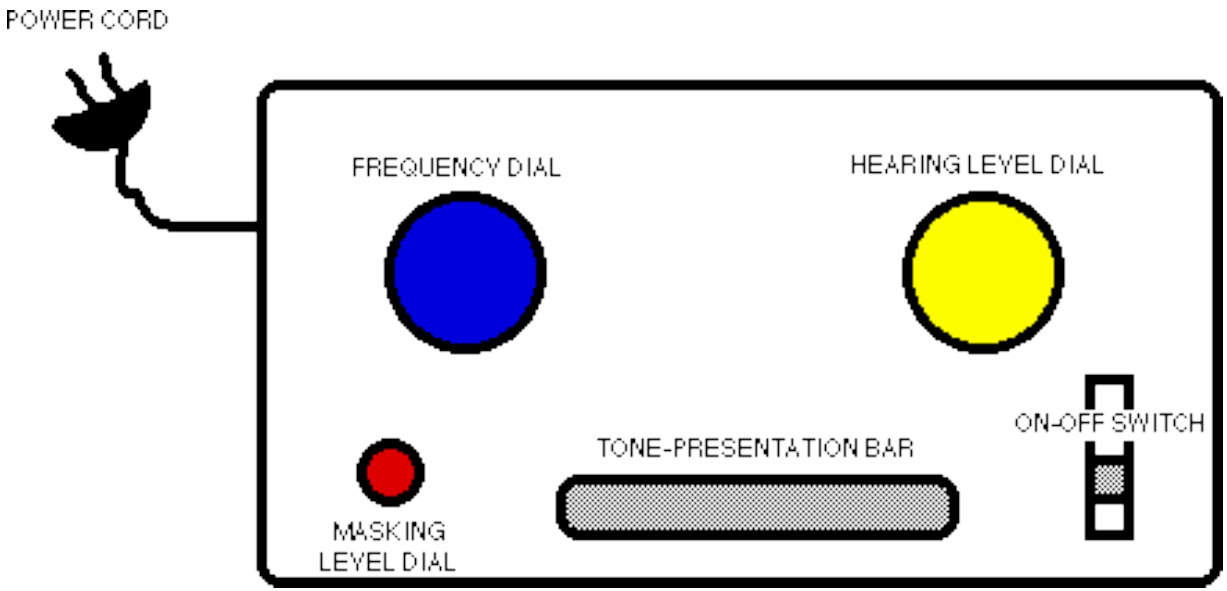
- Must be cleaned and sterilized after each use
- Includes objects that touch blood, mucous, ear drainage, cerumen or other bodily fluids
  - Probe tips for tympanometry testing
  - Non-disposable otoscope speculae
  - Ear gauges

Infection Control

Non-Critical Audiometric Equipment

- Must be cleaned and disinfected using disposable germicidal pre-moistened cloths, or hospital grade disinfectant
  - Headphones/earcups
  - Headbands
  - Hand Switch/Response buttons
  - Environmental surfaces in patient care area

QUESTIONS???


POWER CORD
FREQUENCY DIAL
HEARING LEVEL DIAL
ON-OFF SWITCH
TONE-PRESENTATION BAR
MASKING
LEVEL DIAL